GUIDELINES FOR

THE DISPOSAL OF WASTE PESTICIDE AND PESTICIDE CONTAINERS ON THE FARM

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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1. INTRODUCTION

Production and use of pesticides around the world leads to the generation of waste pesticide and used pesticide containers at a number of stages between the manufacturer and the farmer. Quantitatively, the processes of manufacture and formulation are the most important points of pesticide waste generation, but the potential hazards associated with waste pesticides and containers on the farm are sufficient to require special attention.

This document is aimed primarily at government agricultural officers, agricultural consultants and others 'in the field' who may be asked by farmers for information about pesticide handling, use and disposal. It contains an outline of the nature of the disposal problem, detailed procedures for use by farmers in disposing of containers and waste pesticide and an Appendix which provides background information on the various approaches which may be made to effect disposal. The Appendix also provides a guide to further reading for those wishing to obtain more detail on particular methods.

In the period since World War II, there has been a steady increase in the production and use of synthetic pesticides throughout the world, and at present, the annual world-wide production of active ingredient is between two and three billion kilograms. The wide range of toxicological and environmental hazards associated with pesticides is well known, and much research effort is aimed at the development of pest control methods which will reduce the amount of pesticide necessary. At present, however, there is little to suggest that significant overall reductions will occur in the foreseeable future, and it is more likely that increasing use will be the continuing trend. A different approach to reducing some of the hazards is the move towards invention and commercialization of novel pesticides with a relatively low toxicity to non-target species, and shorter duration of action in the environment. This favourable trend will probably be furthered by products emerging from biotechnology, and whilst such changes are welcome in terms of both use and disposal of pesticides, it is important that two important facts relating to disposal are recognised: firstly, the large number of pesticides currently in use involve a wide range of properties, and secondly, the quantities needing disposal will probably grow larger in parallel with increasing pesticide use. It therefore seems prudent that advice on safe and effective disposal methods for waste pesticide and containers is made readily and widely available to farmers, preferably before the information is actually required.

Empty or partly empty pesticide containers are found wherever pesticides are used on a farm, and in general the farmer views container disposal as a task which is neither easily nor quickly executed. In the case of pesticides, wastes at use-concentration or less would be generated on almost all farms on which pesticides are used. Wastes of pesticide concentrate (emulsions, powders, granules, etc.) are not as common, and for example, in countries such as Australia or the UK, will be found on approximately 15% of farms at any one time.

Each aspect of pesticide handling has its own type and degree of potential hazard. In the case of managing waste pesticide and containers, poor practices may lead to effects varying from acute through to chronic toxic exposure, in adults and children, pets, livestock and working animals, wild-life, and especially aquatic life. The result of exposure to waste pesticide will normally be the same as exposure in any other situation: whether exposure comes from concentrated or dilute pesticide, or from leaked, spilt, stored, or poorly disposed wastes, the toxicological outcome will depend upon the organism exposed, the situation in which exposure occurs, the duration of exposure, and upon the many variables relating to the pesticide itself, particularly concentration. These comments apply equally to waste pesticides and to the wastes in 'empty' containers, which, in practice, differ little from pesticide in full containers.

As observed above, generation of empty pesticide containers, and of waste diluted pesticide is a routine occurrence on most farms where pesticides are used, whilst the generation of waste pesticide concentrates is not. The latter generally requires special circumstances, such as:

(i) suspension or banning of sale of a pesticide;

(ii) decreasing acceptance, for whatever reason, of a particular product among farmers;

(iii) contamination of a packaged pesticide by another pesticide (particularly if by a herbicide);

(iv) stockpiling on the farm of a pesticide, for whatever reason;

(v) increase in resistance of a target species to a particular pesticide or pesticide class;

(vi) the crop which was host to the target pest species is no longer grown;

(vii) the pesticide's shelf life has expired, or it is probable that its potency is significantly reduced;

(viii) degradation of a container to the point of breakage, or possible breakage if moved;

(ix) physical damage to a container making decanting of contents impossible.

It can be seen from the list that the reasons for the generation of waste pesticide concentrates may be grouped. In some cases, generation is the result of decisions by the individual farmer, and such occasions are largely unpredictable. In other cases, however, the casual factor may operate throughout an agricultural region, a state or a nation, or perhaps even world-wide. It is important that agricultural authorities, including regional agricultural officers, etc., are alert to these various situations which trigger the generation of unwanted pesticides, and that they initiate suitable action. Ideally, preparation for coping with such eventualities should be made in advance.

2. DISPOSAL OF WASTE PESTICIDES AND PESTICIDE CONTAINERS ON THE FARM

Empty containers and unwanted pesticides can be serious hazards if they are not disposed of properly. There is hazard to the general public, children in particular, risk of contamination of environment and hazard to wildlife. The immediate effects of faulty disposal may be readily seen as sickness and death in people or animals but the long term effects often pass unnoticed for months or years. The long term effects can be prevented. Safe disposal is essential and is an important part of the overall responsiblity of every person involved in the handling and appliction of pesticides.

2.1 Pesticides

The farmer should be encouraged to buy only the amount needed to treat the crop. Only as much pesticide as is needed for immediate use should be mixed at any one time.

The first choice in disposing of waste diluted pesticide should be double spraying of a small part of the infested crop or a field adjacent to that sprayed. This should, however, only be done if it will not result in a problem residue on a food or feed crop.

Before considering disposal, the farmer should attempt to find another farmer who could use the material for its normally intended purpose.

The disposal method outlined below is intended for on-farm disposal of surplus diluted pesticide, or pesticide concentrate. In disposing of the pesticide, all of the points below require attention. It is possible that all conditions cannot be met on every farm, but serious efforts should be made to meet as many as possible.

2.1.1 Selection of Disposal Site:

The hole for receiving the wastes should be dug on high flat land, at least 30-60 m away from free water such as streams, dams and wells. The hole should be situated where there is no risk of flooding by surface flow or streams, and it should be free of potential for erosion. The hole should be well away from homes and other buildings, crops and livestock, and should not be in erosion gullies, sinks, dry watercourses, quarries, or near aquifers or underground watercourses. The soil in which the disposal hole is dug should be well drained and readily penetrated by water. The soil should be deep, allowing for percolation through at least 2 - 3 m of soil, preferably partly through a clay horizon, before reaching bedrock. The hole should be situated at a site which takes advantage of warmth from the sun, but not where soil may be dry for months, or cold or frozen. Finally, the hole should be situated in a place which will never be used for any other purpose.

THE HOLE SHOULD BE SOUNDLY FENCED TO KEEP OUT CHILDREN, LIVESTOCK AND WILDLIFE. A GATE SIGN REFERRING TO THE PRESENCE OF PESTICIDES OR POISONS IS RECOMMENDED.

2.1.2 Construction and use of the disposal pit: The surface of the pit should be horizontal, and depending on its surface area, need be no more than 5 to 8 cm below the surrounding surface. It must, however, be sufficiently deep to contain the volumes of liquid which are poured into it at any one time. The pressure of usage should not be such that long-standing pools of pesticide occur, nor should usage be such that a characteristic foul-smelling oxygen-depleted condition is created in the soil.

Where large volumes of pesticide are involved, it should be progressively disposed of into the hole via storage tanks (e.g. 200 litre drums) adjacent to the pit which allow periodic disposal of small parts of the total volume. Consideration could also be given to increasing the surface area of the hole, or to construction of a second hole.

Microbial action is the most important part of pesticide degradation in the soil, and microbial action may be enhanced by periodic incorporation of nitrogenous fertilizers, animal manure or vegetable wastes into the top layers of the pit. In acid soils, lime may also enhance microbial action.

Pesticide concentrates should be diluted to use-strength before disposal. To ensure ready penetration of the wastes into the soil, it may sometimes be necessary to break up the surface of the hole, prior to disposal.

2.2 Pesticide Containers

2.2.1 Decontamination

In general, all used pesticide containers should be decontamined before disposal. The three stages for decontamination are:

i) empty the contents of the container into the mixing tank, and drain for 30 seconds;

ii) rinse the container at least three times with a volume of water not less than 10% of the container's total volume;

iii) add the rinse each time to the mixing tank.

Rinsing will not render any container suitable for use for storage of food, feed or water for domestic consumption.

2.2.2 Disposal

(a) Combustible containers should be burnt except where, in the case of some herbicides, labels warn against burning (see (c) below). Burning should be carried out where wind will not cause contaminated smoke to drift over nearby homes, people, livestock, crops, or the persons doing this job. Some municipalities have restrictions against burning; local authorities should therefore be consulted before burning pesticide containers.

Caution: drums or bottles may be under the pile to be burned. Ensure that bungs and caps are removed, or that containers are punctured to prevent explosions.

(b) Non-combustible containers

i) large containers: after rinsing, as above, 50L and 200L drums should be disposed of in one of the following ways:

- return them to the supplier; or
- sell them to a firm dealing in used drums or barrels that is equipped to neutralise the toxicity of adhering materials. Contact your pesticide dealer for the names and addresses of such firms; or
- take them to a sanitary landfill type of dump. Inform the operator of the dump that the drums contain residues of poisonous materials; warn him that poisonous vapours may be produced if the containers are burned. Before leaving, remove lids or bungs from the containers; chop holes in the containers with a sharpened pickaxe to prevent re-use. Make sure the site cannot contaminate a water supply; or
- if none of the preceding disposal means are available to you, find a private disposal site of the type described above which you will use only for empty containers and unwanted pesticides. Correct site selection is most important. Before leaving, again ensure lids or bungs are removed from the containers and chop holes in them with a pickaxe to avoid re-use.
- do not re-use for any purpose.

ii) small containers (up to 20L): after rinsing, as above, small containers may be disposed of at a public dump or buried at least half a metre deep at a private disposal site. First remove the caps or lids, punch holes in metal containers, break glass

containers. Do not use containers for storage of food, feed or water for domestic consumption.

(c) Herbicide containers: disposal of some herbicide containers, particularly those for phenoxy-acid herbicides, requires extra care to prevent crop damage. Take the precaution of triple rinsing as above, before disposal, preferably tipping the rinse into the spray vat for use. If this is not possible, tip rinse water into the disposal pit. Disposal of herbicide containers can then proceed as follows:

- burn containers except where labels advise against it. When some herbicides or defoliants volatilize the resulting vapours may be poisonous to humans, or they may damage nearby crops or shrubbery. Herbicides or defoliants containing chlorates may explode when heated.

- break glass herbicide containers. Chop holes in top, bottom and sides of metal containers, so they cannot collect water or be re-used, or crush them under a tractor wheel or with an axe or sledge hammer. Also crush fibre drums, cardboard and paper containers. After breaking, crushing or puncturing them, bury the containers at a depth of half a metre or more at a safe disposal site, or take them to a dump that does not burn its refuse.

APPENDIX

1. METHODS OF DISPOSAL

This section outlines a number of methods of disposal which may be adopted. In each case, an outline of the method is given, as well as a consideration of the limitation, advantages and disadvantages of each. These guidelines will not be suitable for all situations, regions, or countries, it is suggested that in such a situation, further information is sought on other methods which may be more suitable. The reading list (page 12) guides the reader to suitable literature.

The methods described for disposing of pesticides and containers apply principally to disposal on the farm, but some information is given on page 9 on methods which may have application for central disposal.

1.1 Disposal of Pesticides

The ultimate aim of any disposal action is to render the pesticide permanently harmless to all life forms. Where this is not possible in the farm situation, it may be possible to adopt a compromise solution, which partly or largely achieves this goal.

The pesticide for disposal will generally be in one of three forms: it will be surplus diluted pesticide, rinsate from the cleaning of equipment, or pesticide concentrate (generally in the manufacturer's container, as emulsion, powder, granules, etc.). The method of disposal or detoxification generally subjects the pesticide to one or more of the three basic types of action:

- physical actions include fixation, adsorption, incineration, photodegradation or similar action;
- chemical methods may employ reagents which cause, for example, hydrolytic, oxidative or reductive degradation of the active ingredients;
- biological approaches generally utilize microbial action, or microbial products in one form or another.

Included in all three classes are methods which make use of highly sophisticated apparatus, which, because of cost, are suitable only for large quantities of pesticide, or for use on other types of chemicals as well. The methods outlined below are basic, and require relatively simple, but not always cheap apparatus suitable for the farm or closely allied situations.

In terms of cost, convenience and safety, it is better to avoid the necessity for disposal by the transfer of unwanted pesticide concentrate either to another farmer for normal use, or where possible, back to the retail supplier. Users should be encouraged to purchase the correct quantity of pesticide, and to prepare the correct volume of diluted pesticide to reduce the potential for generation of waste pesticide. In some circumstances it is possible to store the waste safely until disposal is possible. Also, double spraying of a small part of the infested crop, or a field adjacent to that sprayed may avoid accumulation of waste diluted pesticide.

1.1.1 Physical methods of disposal include incineration, burning, photodegradation, fixation, containment or adsorption. Burning in the normal farm incinerator or rubbish tip will achieve temperatures of approximately 400°C, which is frequently inadequate for complete degradation of the pesticide molecule. In general, this method is not

recommended because of its questionable efficacy and because it may produce noxious by-products or vaporize biologically active substances with possible risk of damage to the environment. At best, it is suitable only for disposal of small quantities of pesticide at any one time. The attraction of burning is that the method is simple and cheap and there are frequent opportunities for it to be used.

Incineration at high temperatures in sophisticated apparatus is suitable for safe and complete disposal of unlimited quantities of hazardous wastes but such methods are unavailable on the farm.

One method employing photodegradation involves exposure of diluted pesticide on impervious surfaces to strong sunlight. In addition to photodegradation, oxidation as well as some microbial action and fixation would be expected to occur. The surface used should be raised above the suroundings and may be concrete, soil, corrugated iron, or similar material. This method is simple, cheap, and convenient. However, it is suited only to small volumes, and is not free of risk to people, animals or the environment. Current research into other photodegradation methods having possible application on the farm includes assessment of the effectiveness and suitability of a combination of UV light and ozone.

Fixation of pesticides in concrete is not a viable option for disposal because of possible leaching, and chemical incompatibilities with the matrix. Adsorption of waste pesticides into activated carbon has potential application for farm disposal, but portable apparatus currently being developed requires more research. Adsorption on clay and organic matter in the soil has good potential for application on the farm, and is discussed further below.

1.1.2 Chemical methods of detoxification. A variety of chemical agents for promoting degradation of pesticides, including concentrated and dilute acids and alkalis, sodium or calcium hypochlorite, iodide, metals, sulphides, cyanide, acetone, and acetate salts has been assessed. For a chemical method of disposal to be acceptable for farm application, the reagents must be cheap and readily available and they must not introduce hazards greater than those presented by normal handling of the pesticide. The chemical reagents should not present fire or environmental hazards, and information should first be available on the degree of degradation which they produce, the identity of break-down products and their potential for causing damage in the environment at the time of final disposal. For practical reasons, the disposal method used by a farmer should be suitable for all or most pesticides. Because of these constraints, chemical methods of disposal are generally unsuitable for application on farms. In special cases though, there would be merit in considering the possibility of using chemical methods of degradation under supervision of government or municipal officers.

1.1.3 Biological methods of disposal employ living organisms, or their products. There are three main types of biologically mediated disposal:

A. Land disposal utilizes soil as the disposal medium. In the soil microbial action is the most important agent of degradation. Other important contributions include adsorption and volatilization, and of least importance are processes such as hydrolysis, photolysis, oxidation and other chemical reactions. Whilst much work has been done on the fate of pesticides and other chemicals in soil, relatively little of this has been directed at disposal per se on the farm. This fact, linked with

the wide variety of environmental situations encountered in farm disposal, limits to some degree the applicability of some of the basic research. Nevertheless, because much is known of chemicals in the soil, and of the close interactions between some of these influences, it is possible to make a number of useful generalizations, which have application to disposal of waste pesticides in soil:

(a) water relations influence both hydrolytic and microbial degradation. The response to differing water relations varies between microbial species, but in general bacterial activity is greatest when soil moisture content is near, but not greater than field capacity.

(b) temperature has a profound influence upon growth and activity of soil microbes. Most soil micro-organisms have greatest growth and activity at temperatures between 20°C and 35°C, and in general, activity is greater at the upper end of the range.

(c) Soil pH influences both microbial activity and the chemical stability of pesticides. Microbial activity is influenced by effects of pH on nutrient availability, and in general, the optimum range is pH 6.5 - 8.5. Effect of pH on chemical stability of pesticides is variable, but, for example, many organophosphates are much less stable under alkaline conditions.

(d) soil aeration and oxygen supply must be maintained at the highest level for optimal microbial degradation, and for chemical oxidation. Oxygen supply is determined largely by soil structure and by water status. The presence of free water in the soil is conducive to reducing conditions and anaerobic degradation which is slower than aerobic action.

(e) available nutrients influence microbial growth and activity. Shortage of nitrogen may be a limiting factor, particularly in situations where plant materials are also present.

Further procedures for disposal can be developed if these facts are recognised. For example, degradation by soil microbes will generally be slowed down by heavy or frequent loading with pesticide wastes due to toxic effects of the pesticide on the soil flora, or to development of anaerobic soil conditions resulting both from high microbial oxygen demand, and from frequent addition of water.

Land disposal of pesticides may be carried out in a number of ways:

- land cultivation involves placement of waste concentrate or preferably diluted pesticide onto the plough layer using a conventional mobile spray unit or spray irrigation, followed by disc-plowing. Alternatively, subsurface application may be used in order to reduce volatilization and obviate the need for discing. Ideally, a specific area should be set aside for disposal of pesticides. In order to avoid any contamination of adjacent areas, it should be surrounded by levee banks and drains at the edges, and have a sump for run-off. This method of disposal involves significant costs in time and money when preparing the disposal area, and lacks convenience because of the need

for a specific soil-application operation and perhaps subsequent discing. The need to reserve the area for this purpose is also a drawback to this method. An alternative method of disposal involves application of the waste pesticide onto cereal stubble, followed by burial by plowing. This may be a significant disadvantage in terms of farm management, but otherwise the method is relatively simple and safe but is costly in terms of time and convenience.

- disposal pits on the farm may take two possible forms. Firstly, a pit may be a simple hole dug in the ground, and used for disposal of concentrate or diluted pesticides, and perhaps also for containers. For safety and effectiveness, location and design of such burial sites is important (see para 2.1.1, page 3). However, in general the method is simple, cheap, convenient and safe, and has reasonable flexibility of siting. There may be limitations on the frequency and rate of loading if degradation, as opposed to dispersal, is to be achieved, and if environmental pollution is to be completely avoided.

  The second type of pit does not strictly fit the definition of land disposal, and is best suited to disposal of relatively high volumes of waste as found on big farms, orchards, etc. The pit may be up to 4m by 10m, is lined with concrete or plastic and contains alternating layers of soil and gravel. Developmental work on these pits has been carried out over a period of approximately fourteen years and the system has been shown highly effective for a wide variety of pesticides. The system is compact, contains the wastes at the site of disposal, and has reasonable flexibility of siting. The cost is considerable and not much is known of the suitability for degrading concentrates, or of the longevity of the system.

B. Composting of waste pesticide using sewage sludge, animal manures, cannery and other organic wastes as the detoxification and/or the disposal medium is presently receiving active research effort. Results to date are very promising, but data are insufficient to make any general recommendation for the use of these media alone. It would be expected, however, that the use of such wastes in association with soil disposal methods would enhance microbial action by virtue of the nutrient substrate and the 'innoculum' provided, as well as any incidental improvement in soil structure, drainage and aeration.

C. Other biological approaches suitable for farm pesticide wastes are also still being researched. In particular, bacterial or enzyme preparations with specific degradative capacity have promise. Developments in this area are likely to be greatly accelerated by advances in genetic engineering.

1.1.4 Evaporation basins are probably best suited to the needs of manufacturers or others with considerable disposal requirements. Evaporation basins are shallow ponds, generally lined with a waterproof material such as plastic. Ideally, evaporation basins are made rainproof with a cover which does not reduce evaporation or the effects of sunlight. Wastes may be detoxified or immobilized by a variety of factors including photolysis, hydrolysis, fixation (by adsorption to sediment), or flocculation. Additionally, some microbial action would be expected. Volume reduction occurs through evaporation of the water.

This method of disposal is simple, convenient, relatively flexible so far as location is concerned and the wastes are largely confined. On the other hand, some initial costs must be incurred, and there is some potential for impairment of air quality through volatilization. There are also limitations imposed on the effectiveness by climate. Periodical cleaning of the basin would be necessary and this then raises a further problem of what to do with the material removed.

1.1.5 Communal disposal methods: there are a number of further methods of disposal, which, whilst suited to disposal of waste pesticides, are too expensive and/or complex for the normal farmer to consider. Such systems are generally suitable for disposal of non-pesticidal chemical waste also, and for that reason, may serve a wider purpose in the community.

Among these larger-scale options are incineration at elevated temperatures (1000°C, or more), biological degradation using trickle filters or activated sludge, or sanitary landfill techniques.

1.2 Disposal of containers:

In general, all used pesticide containers should be decontaminated as far as possible prior to disposal. However, decontamination is strongly recommended for non-combustible containers, and for combustible containers which have held highly volatile compounds such as phenoxy herbicides, or particularly toxic compounds. The three steps for decontamination are outlined on page 3-4. Proper rinsing will allow containers to be used except for storage or food, water or feed. The importance and significance of this statement in countries where the utility and intrinsic value of empty containers is particularly high should be recognised.

The disposal method for containers varies according to type. Where containers are combustible, they should be burnt on a open fire, or deposited at a public tip which accepts toxic refuse of this type. Non-combustible containers should have their bungs or caps removed, their walls holed, then be crushed and buried on the farm, or delivered to a public tip which accepts such refuse.

It is sometimes possible for empty containers to be returned to the chemical manufacturer or recycled by a competent company.

2. GENERAL CONSIDERATIONS

Section 1 briefly outlined the major methods for disposal of surplus pesticide, the limitations of these methods, and some of the attendant safety considerations. The following comments outline the various general points which must be considered in selecting the best method of disposal:

(a) in general, it must be assumed that the farmer is a layman in terms of handling chemicals and understanding chemical reactions. It may also be generally assumed that the farmer will have only a minimal number of chemical reagents or suitable equipment on hand, and limited access to the chemicals necessary for detoxification;

(b) in general, and particularly where chemical methods of detoxification are involved, any reaction should not involve greater risk than normal handling of the product according to the manufacturer's instructions;

(c) it is preferable that any disposal method used should lead to complete detoxification rather than relying on containment, dilution, immobilization, adsorption, etc.;

(d) disposal should be carried out in a way which ensures permanent and effective exclusion of people, animals, etc., from risk of exposure right through until such time that detoxification is complete;

(e) disposal methods which lead to reduced water quality, or additional pesticide residues in foodstuffs should be avoided or minimized, or managed in such a way that water concentrations or residue levels do not exceed legal limits. Similary, impairment of air quality, or contributions to solid waste disposal problems should be avoided;

(f) the method which is cheap and expedient (among other things) will find greatest favour with farmers. It is preferable also, in the interests of acceptance, that the farmer should need to use only one method of disposal for all products. In this context, it should be pointed out that some physical and chemical methods require two distinct steps - one of detoxification, and later, one of actual disposal.

3. RECOMMENDATION FOR FARM DISPOSAL

Disposal in the soil is the most suitable for the farm situation. Such a recommendation is made in a number of countries. The method is cheap and simple, particularly where carried out in a pit of reasonable size in relatively permeable soil, and it makes use of a variety of degrading or detoxifying mechanisms. It is probably effective in achieving the aim in most cases. In fact, with the correct use, effectiveness probably increases with time over the active life of a pit. The act of disposal brings with it no greater hazard than occurs with normal handling and no special equipment is required. With suitable care in siting, there is no significant contribution to water or air pollution, nor is there any significant threat to living organisms, other than soil-dwellers in the immediate vicinity of the pit.

It is possible, however, that disposal in such pits, even if carried out largely as recommended, is limited in its effectiveness and safety in some situations. For example, it may be necessary to adopt a different approach in areas where

- soil is sandy and dry (low microbial growth and activity, low soil adsorption capacity)
- quantities larger than the pit can effectively hold and/or degrade are involved
- water tables are high, and the possibilities of water pollution or slow anaerobic degradation exist.

It is also possible that, in certain areas or countries, disposal by this means is illegal. Even where these various constraints exist, it is essential that the farmer has recourse to one of two possible sources of assistance. Either, he must be able to transport his wastes, without undue trouble, to a communal disposal service (or leave his wastes with a co-ordinating body such as a government agricultural department, for subsequent disposal), or he must be able to obtain quick reliable information on alternative and acceptable methods of farm disposal. It is important that government agricultural officers, particularly extension officers, prepare themselves in advance with information on disposal which is appropriate for their region.

4. FARMER EDUCATION

The farmer or property manager must ultimately be responsible for the safe and effective disposal of waste pesticide on his property, or for removal of waste to another site where safe disposal is possible.

Education of farmers in methods for disposing of waste pesticides and containers is probably best carried out as part of a broader programme aimed at improving all aspects of pesticide handling and use. Whilst legislation relating to disposal of pesticides can be formulated or may already be laid down, unless it is both very specific and very actively policed, it will be at best, only a useful back-up to education.

Because of the limited amount of space available, label instructions on disposal can generally only be brief, and therefore of limited value. For that reason it is recommended that separate educational material should be widely distributed among all users of pesticides.

5. FURTHER READING

1. Disposal by Chemical Means

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